Allowable Subject Matter

The Official Action dated October 2, 2002 indicates that claims 4-24, 29-41 and 45-51 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Applicants thank the Examiner for this early indication of allowable subject matter.

In light of the indication of allowable subject matter, Applicants have incorporated the subject matter of claim 10 into independent claim 1. Additionally, Applicants have incorporated the subject matter of claims 26 and 31 into independent claim 25. Applicants respectfully submit that independent claims 1 and 25 and the corresponding dependent claims are in condition for allowance.

Applicants make no representation regarding the rejections of claims 1 and 25. Applicants are merely rewriting claims 1 and 25 as suggested by the Examiner to speed the allowance of this case.

New Claims

New claims 54-60 are added herein. Applicants submit that these new claims include limitations that are distinct and non-obvious. Independent claim 54, for example, recites "determining whether the depth values associated with the plurality of pixels are compressible." Additionally, claim 54 recites "responsive to the depth values associated with the plurality of pixels being non-compressible, storing at least an indication of the depth values in a non-compressed form." Applicants submit that these limitations—in

combination with the other limitations of the claim—distinguish claim 54 from the prior art, including the applied reference.

Those claims dependent from claim 54 also include independently allowable subject matter. Claim 55, for example, recites "determining a gradient corresponding to a depth value associated with a first pixel and a depth value associated with a second pixel." Applicant submits that this limitation is not taught, suggested or rendered obvious by the prior art, including the applied reference. As another example, claim 60 recites "determining a difference between the depth value for the first pixel and the depth value for the second pixel." Applicants again submit that this limitation is not taught, suggested or rendered obvious by the prior art, including the applied reference.

CONCLUSION

In view of the foregoing, Applicants respectfully submit that no further impediments exist to the allowance of this application and, therefore, solicit an indication of allowability. However, the Examiner is requested to call the undersigned if any question or comments arise.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-1283.

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Respectfully submitted,

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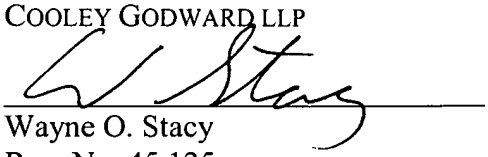
By: 

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APPENDIX A

1. (amended) A computer graphics system for processing image data including Z data for use in displaying three dimensional images on a display unit, comprising:

a depth buffer providing for temporary storage of Z data; and

a graphics processing unit having a graphics engine for generating image data including Z data, and a memory interface unit communicatively coupled to the graphics engine and communicatively coupled to the depth buffer via a depth buffer interface, the graphics processing unit being operative to compress at least a portion of the generated Z data, to write the compressed portion of Z data to the depth buffer via the depth buffer interface in a compressed format, to read portions of compressed Z data from the depth buffer via the depth buffer interface, and to decompress the compressed Z data read from the buffer;

wherein the graphics engine comprises:

a plurality of graphics pipeline stages for generating image data including Z data; and

a Z raster operations unit communicatively coupled with the memory interface unit, the Z raster operations unit for receiving the generated Z data, and being operative to compress selected portions of the generated Z data, to receive compressed Z data from the depth buffer via the memory unit interface and the depth buffer interface, and to decompress the compressed Z data;

whereby effective Z data bandwidth through the depth buffer interface is maximized in order to facilitate fast depth buffer access operations.

11. (amended) A computer graphics system as recited in [claim 10] claim 1 wherein the Z raster operations unit is operative to perform read modify write operations including the steps of:

reading previous Z data from the depth buffer via the memory unit interface and the depth buffer interface;

merging the previous read Z data with associated portions of the generated Z data to provide merged Z data; and

writing the merged Z data to the depth buffer via the memory unit interface and the depth buffer interface.

12. (amended) A computer graphics system as recited in [claim 10] claim 1 wherein the Z raster operations unit is operative to perform read modify write operations including the steps of:

reading previous compressed Z data from the depth buffer via the memory unit interface and the depth buffer interface;

decompressing the read Z data;

merging the decompressed Z data with associated portions of the generated Z data to provide merged Z data; and

writing the merged Z data to the depth buffer via the memory unit interface and the depth buffer interface.

25. (amended) A graphics processing unit for processing image data including Z data for use in displaying three dimensional images, the graphics processing unit being adapted

for coupling with a depth buffer via a depth buffer interface, the depth buffer providing for temporary storage of Z data, the graphics processing unit being operative to compress at least a portion of the Z data, to write the compressed portion of Z data to the depth buffer via the depth buffer interface in a compressed format, to read portions of compressed Z data from the depth buffer via the depth buffer interface, and to decompress the compressed Z data read from the depth buffer, the graphics processing unit comprising:

a graphics engine for generating image data including Z data; and

a memory interface unit communicatively coupled to the graphics engine and being adapted for communicative coupling with a depth buffer via a depth buffer interface;

wherein the graphics processing unit is operative to perform read modify write operations including the steps of:

reading previous Z data from the depth buffer via the memory unit interface and the depth buffer interface;

merging the previous read Z data with associated portions of the generated Z data to provide merged Z data; and

writing the merged Z data to the depth buffer via the memory unit interface and the depth buffer interface.

[whereby effective Z data bandwidth through the depth buffer interface is maximized in order to facilitate fast depth buffer access operations.]

27. (amended) A graphics processing unit as recited in [claim 26] claim 25 being further operative to compress selected ones of a plurality of tiles of the generated Z data based on a quantitative analysis of the Z data, each of the tiles of Z data having a plurality of pixels arranged in an array, each of the pixels being disposed at an associated (X,Y) coordinate of the array, and having an associated Z value.

30. (amended) A graphics processing unit as recited in [claim 26] claim 25 wherein the graphics engine comprises:

a plurality of graphics pipeline stages for generating image data including Z data; and

a Z raster operations unit communicatively coupled with the memory interface unit, the Z raster operations unit for receiving the generated Z data, and being operative to compress selected portions of the generated Z data, to receive compressed Z data from the depth buffer via the memory unit interface and the depth buffer interface, and to decompress the compressed Z data.

32. (amended) A graphics processing unit as recited in [claim 26] claim 25 wherein the graphics processing unit [Z raster operations unit] is operative to perform read modify write operations including the steps of:

reading previous compressed Z data from the depth buffer via the memory unit interface and the depth buffer interface;

decompressing the read Z data;

merging the decompressed read Z data with associated portions of the generated Z data to provide merged Z data; and

writing the merged Z data to the depth buffer via the memory unit interface and the depth buffer interface.

33. (amended) A graphics processing unit as recited in [claim 31] claim 25 wherein the read modify write operations further include the steps of:

compressing the merged Z data; and

writing the merged Z data to the depth buffer via the memory unit interface and the depth buffer interface in a compressed format.

37. (amended) A graphics processing unit as recited in [claim 26] claim 25 wherein the [Z raster operations] graphics processing unit further comprises:

a write operation accumulation unit for receiving the merged Z data, and being operative to accumulate portions of merged Z data that are associated with a current tile of merged Z data; and

a compression engine for receiving the accumulated merged Z data, and being operative to compress the accumulated merged Z data to provide compressed Z write data to the memory interface unit to be written to the Z buffer in a compressed format.

39. (amended) A graphics processing unit as recited in [claim 26] claim 25 wherein the memory interface unit further comprises a tag memory storage unit for storing the compression status information, the tag memory storage unit being responsive to a

particular one of the memory address values, and operative to provide the compression status information associated with the particular memory address value.